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that in the most complicated pedicellariæ known, with a freely movable stalk and with snapping jaws, we have only a very gradual modification of the simplest sort of limestone network found in all Echinoderms in the earliest stages of the embryonic development, while still in the Pluteus-stage, and that we have an unbroken sequence from this primitive network to form, on the one side the most diversified spines, and on the other equally variable pedicellariæ, and that we must consider the latter in their most complicated forms as nothing but highly specialized spines.

REVIEWS AND BOOK NOTICES.

THE DEPTHS OF THE SEA.* —One could not but form a favorable impression of this sumptuously printed book from its attractive exterior; the pleasant impression is deepened by a perusal of it. The narrative is on the whole clear and graceful: the novelty of the facts and the fine illustrations will interest the lay reader, and the scientist will find placed before him in an accessible form the results obtained by the British explorations by means of the dredge and thermometer in the depths of the eastern north Atlantic and the Mediterranean Sea.

The marine zoologist will be led after reading it, as perhaps not before, to study more carefully the temperature and chemistry of the water in which he dredges, while the broader questions of the geological and geographical distribution of animals will engage his attention perhaps the more after reading Prof. Thompson's interesting summary of the joint work done by Carpenter, the physiologist and physicist; Jeffreys, the conchologist; and Wyville Thompson, the accomplished zoologist. After the introduction, we have chapters giving an account of the cruise of the "Lightning," those of the "Porcupine;" chapters on deep-sea sounding, and deep-sea dredging, on deep-sea temperatures, the Gulf Stream, the deep-sea fauna, and the continuity of the chalk.

In the introduction (p. 44) the idea is presented that deep-sea forms dredged around the coast of Great Britain, far from being "boreal outliers," as Forbes designated them, "are the inhabitants of an enormously extended zone of special thermal conditions, which 'crops out' as it were, or rather comes within range of the ordinary means of observation, off the coast of Scandinavia."

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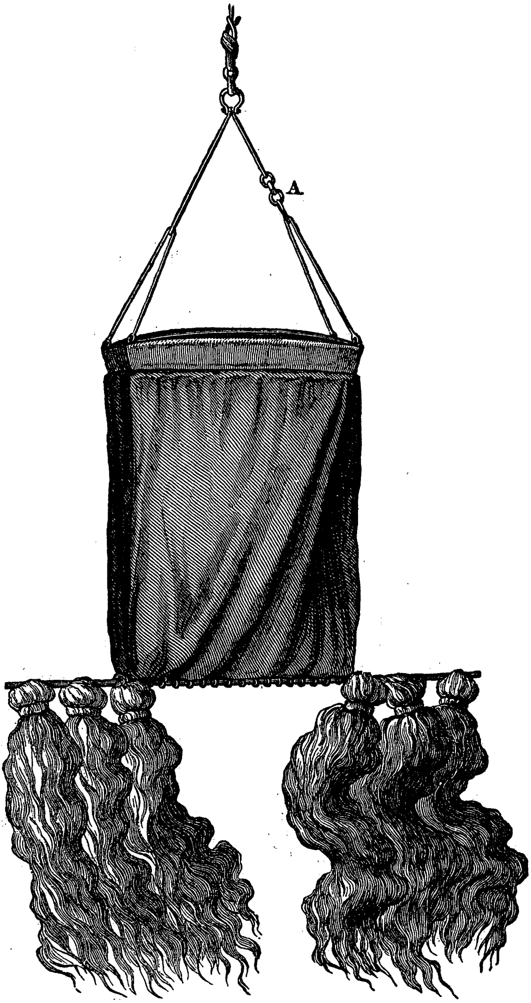
*The Depths of the Sea. An Account of the general results of the Dredging Cruises of H. M. S.S. "Porcupine" and "Lightning" during the summers of 1868, 1869, and 1870, under the scientific direction of Dr. Carpenter, J. Gwyn Jeffreys and Dr. Wyville Thompson. By C. Wyville Thompson. With numerous illustrations and maps. New York and London, Macmillan & Co., 1873. 8vo. pp. 527. (The illustrations are in part here reproduced, thanks to Messrs. Macmillan, the publishers.)

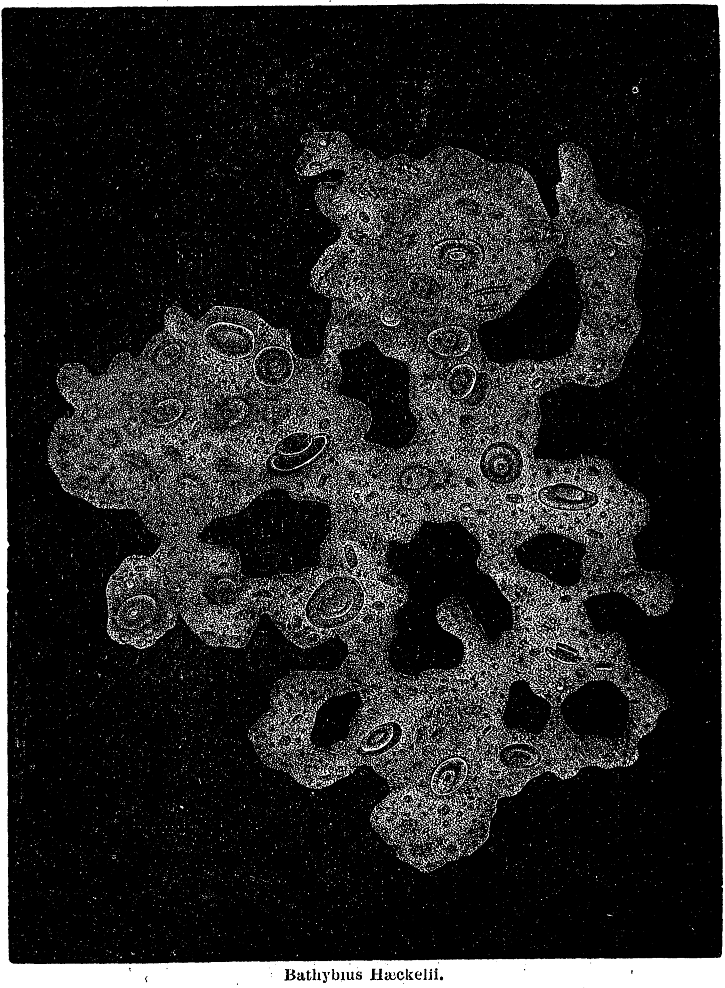
Fig. 106.



Dredge with Tangles attached.

We are not so sure but that Forbes' notion was in the main the more correct one. Certainly from the facts presented in this book, we should gather the impression that the circumpolar fauna tended

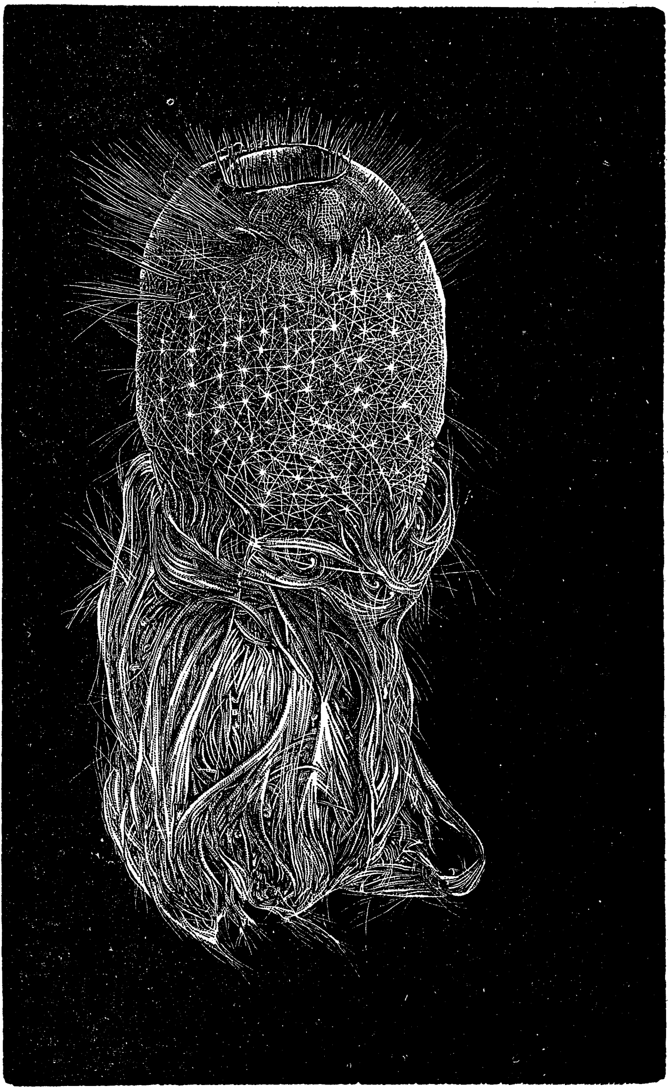
Fig. 107.



Bathybius Hæckelii.

to fade out, even at great depths off the mouth of the Mediterranean Sea; and the few arctic forms dredged off Florida by Pourtalès are mingled at great depths with a much greater abundance of tropical invertebrate life. But the facts brought out by Pourtalès in 1867 and '68 are ignored by Professor Thompson, as we shall see farther on.

Fig. 108.

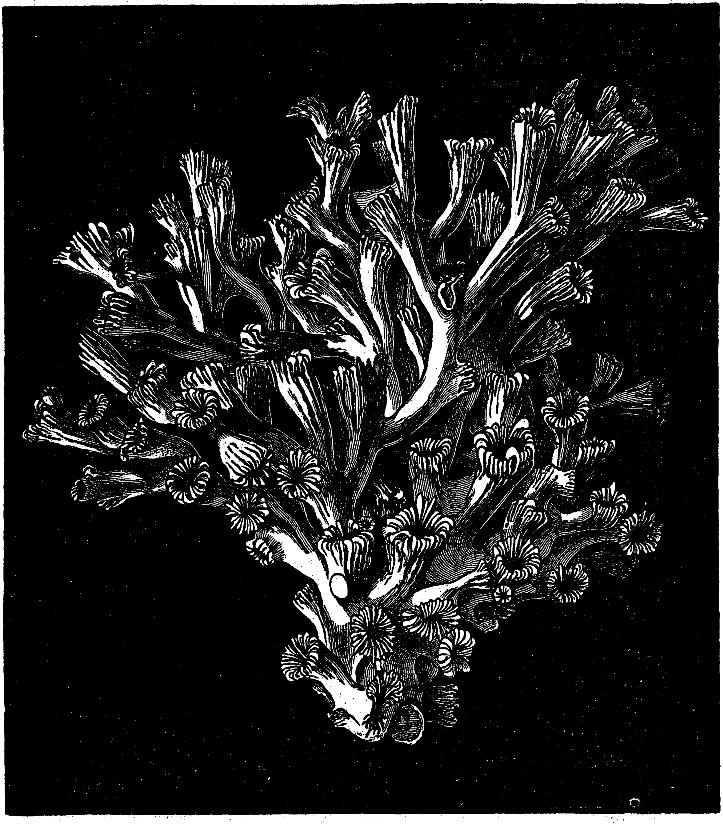


Holtenia Carpenteri.

The idea once so prevalent that animals could not exist at great depths, on account of the supposed great pressure of the sea, is effectually disposed of by the remark that "the organism is supported through all its tissues on all sides, within and without, by incompressible fluids at the same pressure."

The chapter on deep-sea soundings is full in its details and illustrations, and it is concluded from what has been accomplished by American and English naval officers, that "the central and southern parts of the Atlantic appear to be an old depression, probably, at all events coeval with the the deposition of the jurassic formations of Europe, and throughout these long ages the tendency of that great body of water has no doubt been to ameliorate the outlines, softening down asperities by the disintegrating

Fig. 109.



Lophohelia prolifera.

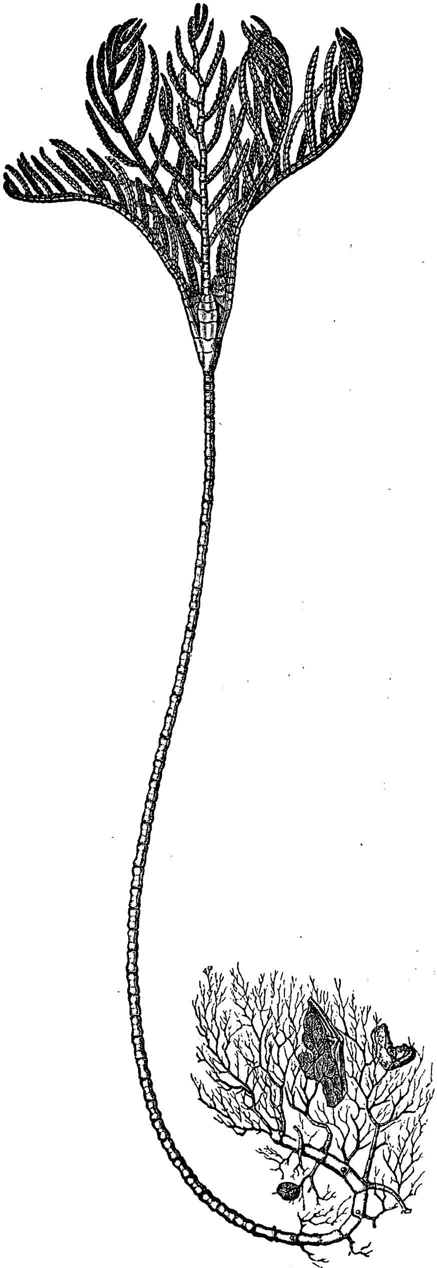


Fig. 110. Rhizocrinus Loffotensis.

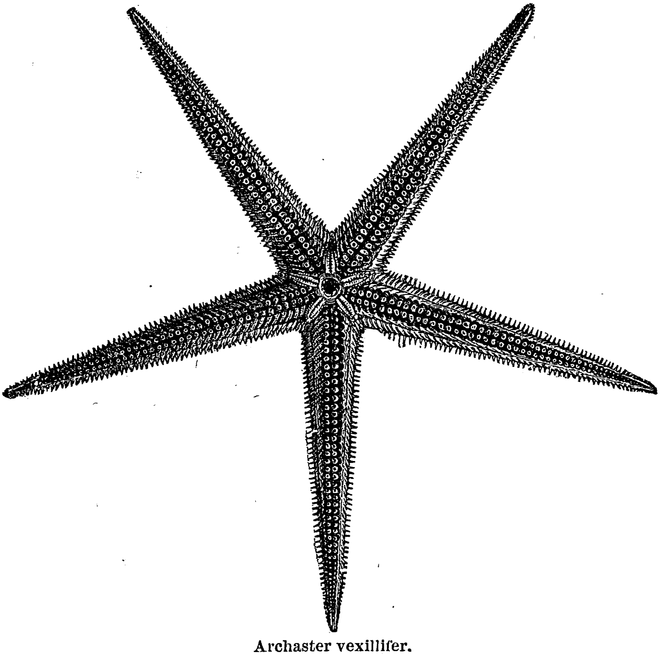
action of its waves and currents, and filling up hollows by drifting about and distributing their materials. . . . . We must regard the Atlantic Ocean as covering a vast region of wide shallow valleys and undulating plains, with a few groups of volcanic mountains, insignificant both in height and extent, when we consider the enormous area of the ocean bed."

The chapter on deep-sea dredging will be found useful and suggestive. We regret to see, however, that in the historical sketch of deep-sea dredging, what had been done previous to British explorations, by Pourtalès under the auspices of the United States Coast Survey is not fully stated. On page 231 of the fifth chapter it is remarked that "dredging operations have been conducted most successfully under Count Pourtalès, and it will be seen hereafter that his results are a valuable complement and corroboration of our own." And on page 277 it is said, "In the year 1868 Count L. F. de Pourtalès, one of the officers employed in the

United States Coast Survey under Professor Pierce, commenced a series of deep dredgings across the gulf stream off the coast of Florida, which were continued in the following year, and were productive of most valuable results."

On turning, however, to the sixth "Bulletin of the Museum of Comparative Zoology," published at Cambridge, Mass., Dec. 26, 1867, we learn that from dredgings off the coast of Florida between May 17th and 29th, and carried to the depth of three hundred and fifty fathoms, Pourtalès concludes that "short as the season's work was, and few as were the casts of the dredge, the highly interesting fact was disclosed, that *animal life exists at great depths, in as great a diversity and as great an abundance as in shallow water*" (the italics are his).

Fig. 111.

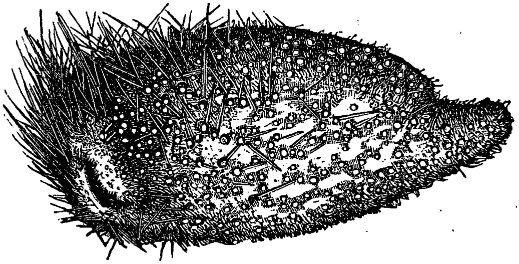


Archaster vexillifer.

The work in the spring of 1868 was carried on at a maximum depth of five hundred and seventeen fathoms: thus two seasons' work was accomplished by the United States Coast Survey before the British Steamer "Lightning" weighed anchor at Oban the 8th of August, 1868, for the first British deep-sea dredging voyage.

To the Scandinavian naturalists (particularly Professor M. Sars and his son G. O. Sars beginning with 1850) however, we owe the impetus, which led American and English naturalists to dredge at great depths. Prof. Lovén, however, in 1863, referring to the result of the Swedish Spitzbergen expedition of 1861, when mollusca, crustacea and hydrozoa were brought up from a depth of fourteen hundred fathoms, expresses the remarkable opinion which later investigations appear generally to support, that at great depths, wherever the bottom is suitable, " a fauna of the same general character extends from pole to pole through all degrees of latitude, some of the species of the fauna being very widely distributed." We reproduce (thanks to the publishers) a figure (106) of the dredge with hempen tangles attached, a most valuable means of fishing up animals such as starfishes, echini and sponges, which the dredge fails to obtain entire or in sufficient numbers.

Fig. 112.

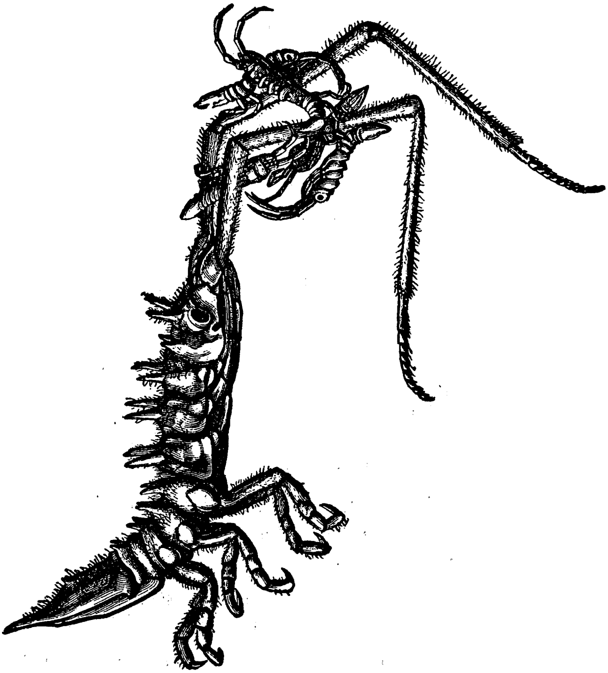


Pourtalesia Jeffreysii.

The exceedingly interesting and able discussion of the origin and relations of the Gulf Stream we must pass over. Our author, however, dissents emphatically from the well known views of his colleague, Dr. Carpenter, on these points. In the account of the deep-sea fauna the *Bathybius Hœckelii* (Fig. 107), which created so much excitement at the time of its discovery, of course is first noticed. Thompson thus speaks of it, "If this have a claim to be recognized as a distinct living entity exhibiting its mature and final form, it must be referred to the simplest division of the shell-less Rhizopoda, or if we adopt the class proposed by Professor Hæckel, to the Monera. The circumstance which gives its special interest to Bathybius is its enormous extent; whether it be continuous in one vast sheet, or broken up into circumscribed individual particles, it appears to extend over a large part of the bed of the ocean." Fig. 107 is a mass of the protoplasmic material of which Bathybius is formed, with Coccoliths embedded in it, magnified seven hundred diameters.

As an example of the sponges abounding at great depths is the *Holtenia Carpenteri* (Fig. 108, half the natural size). A characteristic coral is the *Lophohelia prolifera* of Pallas (Fig. 109, three-fourths the natural size), which at the depths of three hundred to six hundred fathoms "forms stony copses covering the bottom for many miles."

Fig. 113.



Arcturus Baffini.

Among the Echinoderms, the *Rhizocrinus Loffotensis* of Sars (Fig. 110, once and a half the natural size) is interesting not only in itself, but as having been found by Pourtalès to occur in the depths of the Gulf Stream off Florida.

The starfish, Archaster, is characteristic of the abysses of the northern seas, and a fine new form is *Archaster vexillifer* W. Thomp. (Fig. 111). A most singular and intensely interesting sea-urchin is the Pourtalèsia, first found by Pourtalès off the coast of Florida. The British dredgers have revealed a second species (*P. Jeffreysii* W. Thomp., Fig. 112, slightly enlarged). It is closely related to a cretaceous group, the Dysasteridæ. Finally, among crustacea, the sociable *Arcturus Baffini* (Fig. 113, about natural size) with its young clinging to its antennæ is worthy of note as an arctic form.

Many interesting mollusca were obtained, comprising a multitude of new species. Some dredgings in nine hundred and ninety-four fathoms off the Spanish coast revealed "a marvellous assemblage of shells, mostly dead, but comprising certain species which we had always considered as exclusively northern, and others which Mr. Jeffreys recognized as Sicilian tertiary fossils, while nearly forty per cent of the entire number of species were undescribed, and some of them represented new genera." On another occasion in seven hundred and eighteen fathoms off Spain the *Verticordia acutilostata* was taken. This shell "is fossil in the coralline crag, and the Sicilian pliocene beds, and it now lives in the Japanese archipelago."

In the final chapter the doctrine of the continuity of the chalk period with the present is discussed: in other words "that in the deeper parts of the Atlantic a deposit, differing possibly from time to time in composition but always of the same general character, might have been accumulating continuously from the cretaceous or even earlier periods to the present day."

The "Depths of the Sea" is a work that every biologist should read, and for the general student of science it is the only general treatise on this subject. We hope so pleasant and thoroughly educated a narrator as Professor Thompson will be able to favor us with a similar work on the subject, at the close of his "Challenger" cruise. Certainly he will be in a position, if ordinary success attends this important expedition, to give to the world, in connection with American and German observations, results still more comprehensive and conclusive than those flowing from the cruises of the "Lightning" and "Porcupine."

COLOR-VARIATION IN BIRDS DEPENDENT UPON CLIMATIC INFLUENCES.*—The critic's office is not seldom ungracious, and we have

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* On the relation between Color and Geographical Distribution in Birds, as exhibited in Melanism and Hyperchromism [*lege* Hyperchromatism]. By Robert Ridgway. Am. Jour. Sci., 3d ser., iv, Dec., 1872, p. 454; v, Jan., 1873, p. 39.